

29 response

Received by
Examiner
4/11/01**SHARP, COMFORT & MERRETT, P.C.**ATTORNEYS AND COUNSELLORS
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DATE:	April 11, 2001	NO. OF PAGES:	6 (including. this page)
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FOR IMMEDIATE DELIVERY TO EXAMINER MEIER**GROUP ART UNIT 2822**

RE: Application 09160,657

Attorney Docket: UIL-1001-1

Per our telephone discussion.



N. Rhys Merrett

972-702-7940

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application: No. 09/160,657

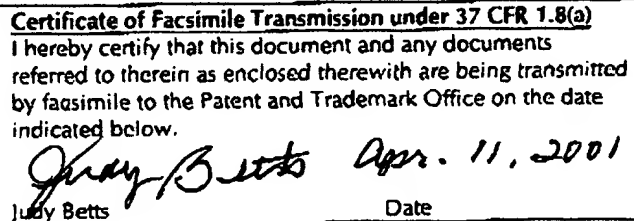
Group Art Unit 2822

Filed: September 25, 1998

Inventor(s): Joseph W. Lyding et al

Examiner: M. Guerrero

For: SEMICONDUCTIVE DEVICES AND METHODS FOR SAME

Assistant Commissioner of Patents
Washington, D.C. 20231Amendment under 37 CFR 111

Dear Sir:

In relation to the Request for Continued Examination of this application mailed February 8, 2001, consideration of the following remarks in response to the Final Office Action mailed January 26, 2001 is respectfully requested.

REMARKS:

Claims 40-48 and 60-65 have been rejected under 35 US 103 as assertedly unpatentable over WO94/19829 (Lisenker et al) and claims 40-48 and 60-61 as assertedly unpatentable over Appl. Phys. Lett. 61 (25), 21 December 1992, pp. 3014-3016 (N. S. Saks et al). These grounds of rejection are respectfully traversed.

Regarding Lisenker, in Section 3., the Office Action states "*Lisenker et al. teaches contacting the silicon wafer with deuterium before, during and/or after formation of the device (page 6, lines 10-15).*" With respect, this is a misstatement because in fact Lisenker et al state in that passage, "*contacting a silicon wafer with deuterium . . . before, during, and/or after formation of a device oxide layer*" (emphasis added) which is not disclosure or suggestion of:

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"the presence of deuterium at said interface resulting from post-fabrication passivation of said interface in a heated, deuterium gas-enriched atmosphere"

as recited in claim 40; or

"post-fabrication passivation is carried out after formation of said conductive contacts and produces a structure including covalently-bound deuterium populating said interface"

as recited in claim 48; or

"post-fabrication heating of the device after formation of said contacts, in a deuterium gas-enriched atmosphere"

as recited in claim 62.

This differentiation is explicitly emphasized by Lisenker et al's teaching that deuterium annealing is to be carried out during fabrication process steps (see for example, page 8, line 29 to page 9, line 4), such as doping, etching, annealing, deposition, cleaning, passivation and oxidation steps, particularly emphasizing the importance of deuterium annealing *"in those fabrication steps in which a permanent oxide layer is being formed or treated"* (page 8, lines 35-37) as contrasted with post fabrication deuterium treatment as required by claims 40-48 and 60-65 of this application.

The comment in the Office Action *"it would have been obvious to a person of ordinary skill in the art to define the practical lifetime of Lisenker et al's device because this was well known in the art"* appears to be a *non sequitur* and is not understood. Clarification would be appreciated.

Regarding the rejection based on Saks et al., in Section 4 of the Office Action, it is presumed the Examiner has conceded that Saks et al does not disclose or suggest the "post fabrication" steps of claims 40 and 48 as recited above in discussion of Lisenker et al.

Regarding both grounds of rejection, based on Lisenker et al. and on Saks et al., it is urged that the W. F. Clark et al. publication, IEEE Electron Device Letters, Vol. 20, No. 1, January 1999, (cited and copy provided in Applicants' response mailed November 2, 2000) authored by individuals of at least ordinary skill in the art, demonstrates that structures

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resulting from the teachings of Lisenker et al and Saks et al do not in fact have the structural characteristics defined in any of claims 40-48 and 60-65 that are a consequence of the post fabrication deuterium treatment set forth in those claims. See Applicants' Response mailed November 2, 2000 at page 5, line 9 to page 6, line 19. In Section 5 of the Office Action, Applicants' arguments based on the Clark et al. and on D. J. Maria references is stated to be "not persuasive" but without any rationale. These references were introduced to present support from individuals of at least ordinary skill in the art, that in the post fabrication structures of Lisenker et al. and Saks et al., the deuterium at the silicon/ silicon dioxide interface due to the earlier annealing process, will no longer effectively remain because of the higher temperature processing, subsequent to the deuterium annealing, required to form contacts to their MOSFET structures. Consequently, Lisenker et al. and Saks et al., fail to teach or to have made obvious at the time of the claimed invention, a process that would have resulted in a post fabrication semiconductor device:

having structure as recited in claim 40 and, inter alia,

characterized by the presence of deuterium at said interface resulting from post-fabrication passivation of said interface in a heated, deuterium gas-enriched atmosphere

or having structure as recited in claim 62 and, inter alia,

structurally characterized by post-fabrication heating of the device after formation of said contacts, . . . to provide deuterium at and to passivate said interface [between a semiconductive silicon layer and a gate oxide layer] so as to increase the resilience of the field effect transistor to hot electron effects.

It is respectfully requested that Applicants' discussion based on these references be carefully reconsidered giving appropriate weight to factual presentations by authors who are individuals of at least ordinary skill in the art, and which support Applicants' position that Lisenker et al. and Saks et al. would not have been operative to produce or suggest how to obtain a structure as set forth in any of claims 40-48 and 60-65.

These structural characteristics of a semiconductor device as set forth in each of claims 40-48 and 60-65 have been discussed in Applicants' Response mailed November 2,

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2000 at page 7, line 19 to page 8, line 9. That is, post fabrication deuterium passivation, as claimed in the claims pending in this application, accumulates deuterium both at the channel-gate oxide and gate contact-gate oxide interfaces mainly from the drain and source sides, as well as from above at the drain contact - silicon and source contact-silicon interfaces. In both Lisenker et al. and Saks et al, deuterium treatment is carried out before contact formation, so that the contact geometries play no part in defining the location of the deuterium. The location and distribution of deuterium in this manner is thus a distinctive structural characteristic consequent to the process steps as claimed in this application and is detectable in the end product. That product is structurally differentiated from and patentable over a product resulting from The rejection of claims 40-48 and 60-61 therefore is respectfully traversed.

In Section 6 of the Office Action, the characterization of US Patent 6,147,014 as "prior art" is not understood. The present application is a continuation of application 09/020,565 on which Patent 6,147,014 issued.

It is also respectfully requested that the above arguments be considered in relation to claims 75-78 presented with the Request for Interference mailed February 8, 2001, together with the showing in that Request and in the Affidavit of Joseph W. Lyding that the semiconductor device recited in those claims is structurally characterized by a concentration of deuterium of "at least about 10^{16} cm^{-3} " at the interface of "a film located adjacent said transistor gate" (claim 75) or "in said gate dielectric film at an interface with said semiconductive layer" (claim 76).

In addition, it is respectfully requested that a typographical error be corrected at page 8, line 6 of the Request for Interference mailed February 8, 2001, by changing "concentration of 75 and 76" to read -concentration of "at least about 10^{16} cm^{-3} ". This inadvertent error is regretted.


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It is believed this amendment and the accompanying remarks have addressed all outstanding grounds of rejection, demonstrated that the claimed invention is patentable over the references of record, and that all of claims 40-48 and 60-65, as well as newly introduced claims 75-78 are in condition for allowance. Early action to that effect will be appreciated.

If after consideration, the Examiner believes that further prosecution of the application may be facilitated by discussion, a telephone call to the undersigned attorney at 972-490-3695 will be appreciated.

Date: April 11, 2001
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Respectfully submitted,


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